CHAPTER 2

BEST MANAGEMENT PRACTICES

Contributions from nonpoint source pollution, derived from urban runoff and storm sewers, still remain leading sources of water quality impairment of beneficial uses of rivers and lakes throughout the country.

— U. S. Environmental Protection Agency 305(b) report, 1994

The existing site topography and vegetation can often be effective in naturally treating and disposing of volume and quality of stormwater runoff, when left undisturbed or intact as much as possible. Typically, non-disturbed dips and depressions within a site are able to collect and store water, coupled with the site's existing vegetation, that provides a filter function for both pollutants and sediment. This natural drainage system works jointly to also regulate water quantity. When a site's hydrology is altered by the loss or the compaction of topsoil, impervious coverage by paving, asphalting, or concreting, post-development drainage if not controlled through either source or treatment control measures causes increased runoff. It may not necessarily be the individual development site, but rather, the cumulative effect of numerous site developments that cause a greater volume, and hence, an impact to nearby and local water bodies.

Best Management Practices (BMPs) are measures or a combination of measures that have been determined to be the most effective and practical means of preventing or reducing contamination to ground water and/or surface water pollution from nonpoint and point sources. The objective in implementing BMPs is to achieve water quality goals and protect the beneficial uses of the water body.

SOURCE AND TREATMENT CONTROL BMPS

Stormwater runoff usually consists of surface runoff from such nonpoint sources as streets, parking lots, and yards. It may also have point source contributions from accidental spills and leaks or illegal dumping of commercial and household wastes into storm drains. Stormwater runoff from residential subdivisions and commercial development contains many small source areas. This type of stormwater runoff is much different from that associated with separate storm sewers or other conveyances. Stormwater runoff discharged through conveyances such as separate storm sewers is legally, a point source under the Clean Water Act and is subject to the National Pollutant Discharge Elimination System (NPDES) program.

Structural or treatment control BMPs are designed to remove pollutants that are contained in stormwater runoff (Table 4). Treatment control BMPs use a variety of mechanisms to remove pollutants from storm water including sedimentation, filtration, plant uptake, ion exchange, adsorption, and bacterial decomposition. Examples of stormwater runoff treatment BMPs include infiltration trenches, wet ponds, biofiltration swales, and vegetative filter strips. The goal of storm water treatment BMPs is to treat at least 90 percent of the runoff generated by development.

Table 4. *The three functional groups of runoff treatment control BMPs.*

FILTRATION	Treating sheet flow by decreasing the velocity of energy of runoff as it moves through vegetation or sand. The method promotes infiltration and the settling of suspended solids and thus, prevents erosion. Vegetation controls are most effective when used in combination with other urban BMPs, serving as the first step in treating and disposing of storm water. Common examples: vegetated filter strips, grassed swales, sand filters, basin landscaping, and riparian reforestration. Site limitations include easily being clogged with sediment or being inundated with high flows.
RETENTION (Infiltration)	Infiltration permits pollutant removal as runoff percolates through a medium (e.g., clean sand, compost, soil, etc.). Use is restricted by poor site conditions: high water table, compacted soils, and the presence of shallow bedrock. Common examples are: infiltration basins, trenches and dry wells, and porous/modular pavement. Site limitation include: extremely high/low soil permeability, locally high water tables, and a shallow buffer between the surface and underlying drinking water aquifer.
DETENTION	Detention basins act as temporary holding facilities for runoff, allowing suspended solids and associated pollutants to settle out, and delays the release of runoff directly to water bodies. Detention basins effectively reduce suspended solids and particles; they also function in reducing flood impact and streambank erosion, lessening stress on habitats. Common examples are: dry ponds, wet ponds, and constructed wetlands. Site limitations include: difficulty with vegetative stabilization, frequent clogging, and excessive sediment build up.

Source control BMPs are designed to prevent pollutants from affecting storm water by eliminating the source of pollution or preventing contact of pollutants with rainfall and runoff. Source control BMPs are either specific to the type of land use being proposed for development or are intended to control a specific type of pollution problem existing within a watershed, such as excessive nutrients that may contribute to high algae concentrations. Examples of source control BMPs include: limiting fertilizer concentration/application, covering areas used to store stockpiled soil, street sweeping during dry weather conditions, reducing impervious areas, preserving open space, and natural resource planning. Source control BMPs are generally nonstructural in nature and often considered as preventative and planning oriented.

The identification and application of BMPs is broadly based on the goal(s) of the user. Some BMPs are more applicable to planners or community leaders, whereas others are more applicable to engineers, private property owners, or contractors. At the watershed level, storm water management requires a more systematic approach based on the prevailing land use activities and conditions, the water quality goals, and the community resources available for implementation of BMPs. Structural BMPs installed randomly throughout a watershed may provide local treatment, but may contribute to the transfer of pollution from surface to ground water or vice versa (e.g., dry well injection to an aquifer). This transfer can ultimately lead to further nonpoint source pollution.

Community nonpoint source pollution is largely the result of land use activities, yet there are few approaches that truly address their management through nonstructural measures such as land-use planning and performance criteria. Often there is an overwhelming reliance on conventional strategies, such as treatment control BMPs and large lot zoning. However, treatment BMPs, which range in design for controlling runoff, should be considered the "tail end" of any storm water management strategy. For this reason, treatment control BMPs are discussed separately in a *Catalog of Stormwater Best Management Practices (BMPs) for Idaho Cities and Counties*.

DID YOU KNOW?

The City of Boulder, Colorado, Real Estate/Open Space program estimates that it costs approximately $2,500-$3,000 to provide public services to an acre of developed land. The costs of providing public services to open space are $75 per acre (James Crain, Director RE/OS, City of Boulder, 1988 cited in U.S. EPA, 1995).

MANAGING URBAN STORMWATER RUNOFF

The realm of managing urban stormwater runoff includes existing development, as well as plans for new development. In confronting both the correction of existing and the prevention of future problems, two categories of BMPs are often necessary:

1) Watershed planning source control measures: are used to minimize and/or prevent the source(s) of urban pollutants (e.g., limiting impervious area through clustering development).

2) Site design treatment measures: are designed, constructed, and periodically maintained to interrupt the detachment, transport, and subsequent discharge of pollutants.

Stormwater management plans for identifying and correcting current problems address existing stormwater runoff nonpoint sources. Controlling runoff from developed areas tends to be more expensive compared to that associated with managing runoff from new development. Since there is no opportunity for planning upfront, the approach tends to be more deficit oriented and often relies on targeting storm water control projects that provide the highest ratio of cost benefit. The first step identifies the priority pollutants and their associated source(s); as priority pollutants are identified and incorporated together within a runoff management plan for an area, pollutant reduction opportunities are identified. Restoration and other types of retrofit activities should be based on the greatest ratio between economics and the provided environmental benefit(s).

Stormwater management plans for new development should emphasize sustaining predevelopment runoff volumes through the use of source control BMPs. A local stormwater management plan should focus not only on water quantity, but also *water quality*. Stormwater management plans vary and include design strategies to protect sensitive open space areas, minimizing site disturbances, and using the land's natural treatment functions. The purpose of this manual is to present source control measures in a menu format. The measures can be incorporated into local comprehensive plans, ordinances, or public agency programs for managing stormwater runoff caused by new urban or suburban development projects and construction activities.

CHAPTER 3

PROTECTING SENSITIVE OPEN SPACE AREAS

The emerging field of urban watershed protection often lacks a unifying theme to guide efforts of its many participants—planners, engineers, landscape architects, scientists, and local officials. The lack of a common theme has often made it difficult to achieve a consistent result at either the individual development site, or cumulatively, at the watershed scale.

— Thomas Schueler, 1995a

Prevention in site and comprehensive planning is much more efficient and cost effective than retrofitting problems as they arise. A community without comprehensive drainage management can create problems with water quality as urbanization progresses. The further that predevelopment hydrological conditions are altered from initial conditions, the more that anticipated problems can accumulate.

Stream quality is not capable of solely being protected based on instream practices. There must also be a consideration of the activities that take place on the land. The protection of water-based resources from the effects of impaired runoff water quality during and after construction can be costly and often difficult. Local planning can encourage new development in the least sensitive areas of a watershed. New development can be enhanced by planning residential subdivisions around open space areas and preserving the hydrologic function of natural landscapes and drainageways through natural engineering techniques (i.e., incorporating landscaping components). The concept of sensitive open space areas can serve as the common theme for guiding individual site development, and cumulatively, at the scale of the watershed.

SENSITIVE OPEN SPACE AREAS

Natural resources are generally classified as either water-based or land-based. Water-based resources include those areas that hold or store water for some length of time. Some of the more common areas include rivers, streams, lakes, and aquifers. Land-based resources function as a supportive component of water-based resources and their management is often considered integral in their protection. Typical land-based resources include: riparian vegetation, floodplains, wetlands, groundwater recharge zones, or collectively, sensitive open space. Other sensitive open space areas are steep slopes and areas of highly erodible soils.

Descriptions of sensitive open space areas that are essential in protecting water-based resources include:

RIPARIAN VEGETATION. Many types of plants grow in the wetted perimeter along streams and rivers. Riparian vegetation stabilizes stream channel perimeters and plays an indispensable role in preventing erosion. Vegetation functions as a filter trap for suspended sediment from upstream locations. Trees and shrubs provide shade and streamside vegetative communities for fish and other wildlife habitat. By using vegetative set-backs or buffers along the edge of stream channels, there is natural reduction in channel erosion and increased trapping of sediment, nutrients, and other pollutants prior to their reaching the water body.

FLOODPLAINS. Property owners within the 100-year floodplain, which is covered by the National Flood Insurance Program can pay lower premiums by preserving this already natural control for nonpoint source pollution. When development is limited in floodplains, streams and rivers are allowed to flow their natural course and provide unseen benefits through the allowance of providing flood storage, runoff infiltration from upgradient developed areas, and erosion protection.

WETLANDS. Areas that are inundated or saturated by surface and ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (as defined by the Environmental Laboratory, Department of Army, 1987). Once considered an area with little economic value, most wetlands today are recognized for their multitude of benefits. Wetlands have been constructed as a practice for managing stormwater runoff of an area. Wetlands generally support diverse vegetation, which filter suspended sediment and dissolved nutrients from local runoff. Wetlands also provide flood control, functioning as temporary storage areas. Wetland maintenance is accomplished through maintaining or reproducing pre-development hydrology and by providing sufficient runoff pre-treatment.

GROUND WATER RECHARGE AREAS. Over ninety percent of Idaho communities rely on ground water as a source of drinking water and for other domestic uses. Since municipal wells draw water toward them as they pump, the aquifer immediately upgradient from a well or well field is particularly vulnerable to nonpoint sources of pollution. Some typical sources of urban nonpoint source pollution can be traced back to lawn care practices, animal waste, road salt, accumulated oil and gas spills, and toxic materials.

STEEP SLOPES AND ERODIBLE SOILS. The removal of vegetation along hillsides or steep slopes lessens the ability for sediment to remain in place. If structural and temporary controls are not used, the cumulative effect of erosion from site material can devastate surface water bodies. Fine sediment and soil contributes to the degradation of water bodies and acts as a transport agent for pollutants that typically adsorb to their surfaces.

MULTIPLE INTEGRATION GOAL

Several recent themes in subdivision design, landscape architecture, and transportation have come to the forefront in community planning. Promoting the use of "neo-traditional" residential design is one example; open space subdivision design for growing rural or suburban settings, by Arendt (1996), is another. The use of depressional landscaping also fits well. The more that comprehensive design principles can be blended together or integrated, the better the maximization of development economics and environmental benefits. Components of these themes converge toward further use of impervious area as a land development unit. Taken as a whole, the themes serve as complementary initiatives for local planners and land use decision makers in encouraging the protection of sensitive open space areas, while reducing impervious area and minimizing soil loss during construction activities concurrently.

There is an obvious cost benefit when several complementary initiatives can be integrated together to form a common goal. This combination results in a *multiple integration goal*. Using environmental planning to protect sensitive open space serves a multi-functional role, serving many other interests within a community. Some of those simultaneous benefits can include improving community character and quality of life, neighborhood livability, air quality, and residential road safety, among others. Five planning approaches are discussed in chapters 4 and 5, which introduce tools and techniques for protecting sensitive open space. The link between local land use and water quality is achieved through environmental planning that integrates development initiatives around protecting sensitive open space.

COST BENEFIT CASE STUDY

In Prince George's County, Maryland, "rain gardens" were used to filter stormwater runoff as opposed to conventional detention pond facilities. The cost savings was $300,000; the "rain gardens" were $100,000 versus $400,000 for the detention facilities.